

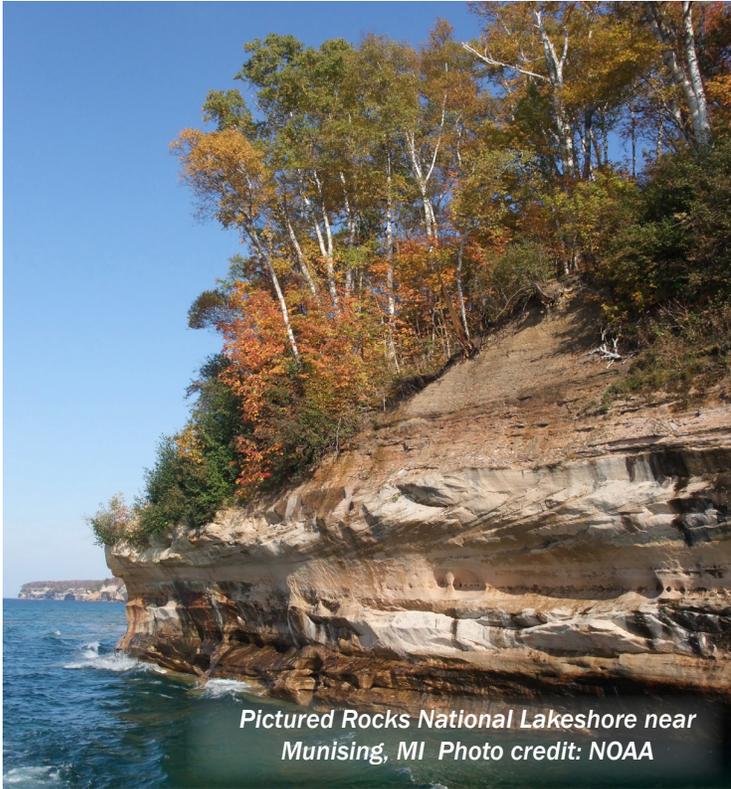


Water Levels of the Great Lakes

September 2016

The Great Lakes, their connecting waterways, and their watersheds, comprise the largest lake system, by surface water, on the planet. The monthly, seasonal, and annual surface water elevations of the lakes fluctuate in response to a variety of factors. This fact sheet provides a brief overview of historical Great Lakes water level patterns and current water levels, as well as the research NOAA conducts through its Great Lakes Environmental Research Laboratory (GLERL) on water budget components and seasonal water level forecasting.

Following El Niño: Will Water Levels Decline?



Pictured Rocks National Lakeshore near Munising, MI Photo credit: NOAA

As predicted during the waning of last winter's strong El Niño, the summer of 2016 was warmer than average with greatly varying precipitation in different parts of the Great Lakes basin. At summer's end, the Palmer Drought Index, a measure of long term drought, indicated conditions ranging from very moist in the west to severe drought in the eastern part of the basin.

Great Lakes water levels began their seasonal decline earlier than usual. Historically, this occurs in late summer to fall. Lake Erie levels started declining in June; Lake Michigan-Huron levels began to decline in August. Additionally, the lakes reached **unusually high surface water temperatures** - 4-6 degrees C above their average (1992-present) by September. This may lead to above average evaporation over the lakes this fall/early winter.

Looking ahead, the NOAA Climate Prediction Center (CPC) predicted (mid-August) warmer than average air temperatures for the fall over most of the basin. Winter in the Great Lakes region, according to CPC outlooks, may be wetter and colder than average. **Will above average winter precipitation come to pass, and overcome the expected greater than average fall over-lake evaporation?**

FOR MORE INFORMATION

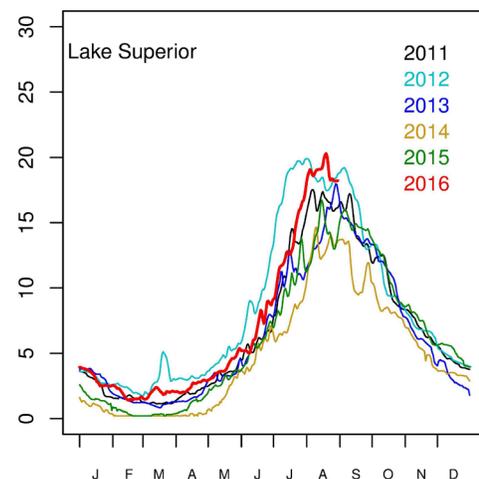
www.glerl.noaa.gov/data/now/wlevels/levels.html

Drew.gronewold@noaa.gov	Historical water level dynamics, seasonal projections	734-741-2444
Eric.j.anderson@noaa.gov	Hourly and daily water level forecasts	734-741-2293
Brent.lofgren@noaa.gov	Decadal water level projections	734-741-2383
Margaret.lansing@noaa.gov	GLERL Information Services	734-741-2210



National Oceanic and Atmospheric Administration
Great Lakes Environmental Research Laboratory
4840 S. State Rd. Ann Arbor, MI 48108
734-741-2235

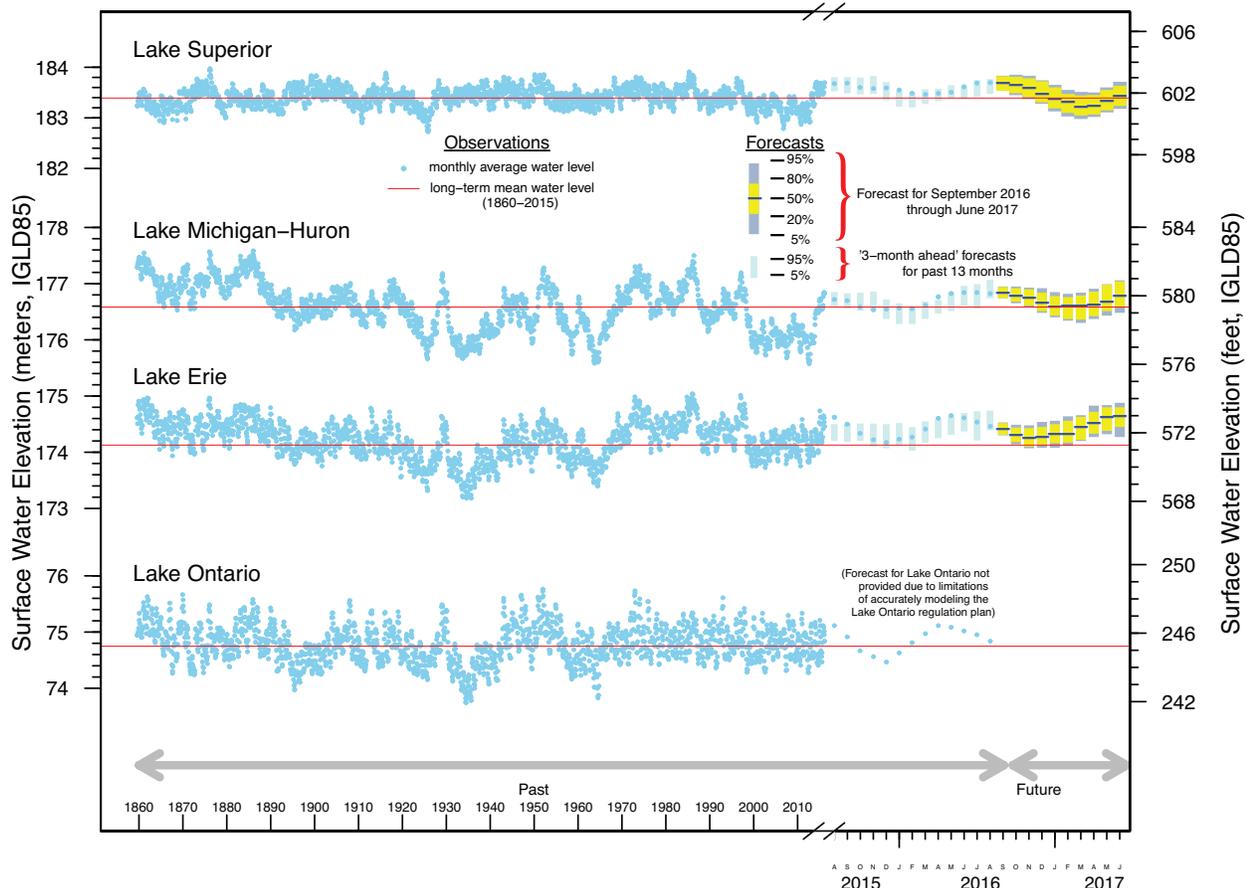
GLSEA Surface Water Temperature



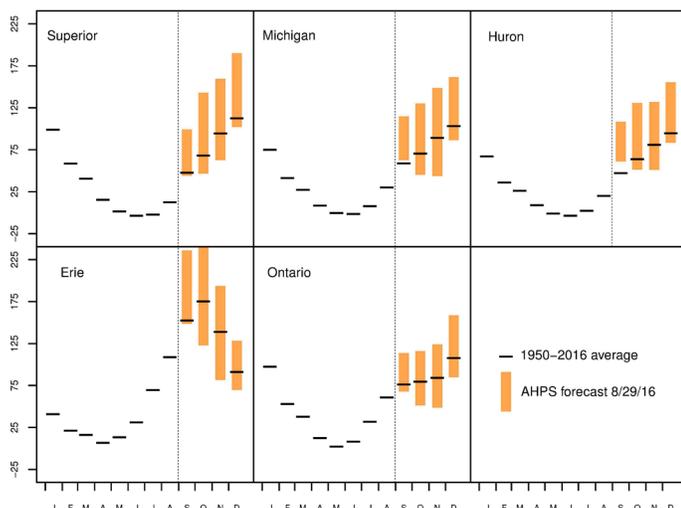
Above: Surface water temperatures for Lake Superior from NOAA CoastWatch's Great Lakes Surface Environmental Analysis (GLSEA) from 2011 through present. Temperatures are in degrees Celsius. Note that August 2016 surface water temperatures recently exceeded those of 2012.

The Current Outlook for Great Lakes levels

The research-oriented forecast generated by NOAA-GLERL's AHPS on September 15 indicates that the water levels of Lakes Superior, Michigan, Huron, and Erie are expected to follow their typical seasonal trends at or slightly above average levels; Lake Erie levels will remain high, while the levels on Superior, Michigan, and Huron are expected to be slightly lower than this summer. The uncertainty expressed in the forecast shown here is based on observed weather patterns and Great Lakes water levels from 1948 to present, along with NOAA Climate Prediction Center's regional forecasts. The 5 and 95% bands are expected to contain the observed water level 90% of the time. The NOAA-GLERL AHPS forecasts are used by the U.S. Army Corps of Engineers and Environment Canada as part of their internationally-coordinated operational water level forecasting systems (www.lre.usace.army.mil/Missions/GreatLakesInformation/GreatLakesWaterLevels/WaterLevelForecast/MonthlyBulletinofGreatLakesWaterLevels.aspx).



Below: *Evaporation forecast for fall 2016 by the NOAA-GLERL AHPS model. Evaporation (in millimeters over each lake's surface) is one of the water budget components that will impact next year's water levels. Note that for all lakes except Ontario, the forecast 90% confidence interval bands are far above average this year.*



How are water levels predicted?

Forecasts of Great Lakes monthly-average water levels are typically based on computer simulation models. One example is the Great Lakes Advanced Hydrologic Prediction System (AHPS), developed by NOAA-GLERL, which combines historical meteorological data with a series of mathematical models and climate forecasts from NOAA's Climate Prediction Center to simulate multiple variables. **The most important variables are overlake precipitation, overlake evaporation, and rainfall-induced runoff.** The sum of these variables ("net" supply of water to the basin) is routed through the lakes and connecting channels using models that reflect flow patterns and regulation rules in order to produce a band of probability-based future water levels.